Loss and damage from droughts: Material and non-material impacts of water scarcity on women farmers in Gugulethu, Cape Town

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Plagiarism declaration

I, Lucy Lavirotte, hereby declare that I know the meaning of plagiarism and that the dissertation that I hereby submit is all my own work.

Abstract

Climate change is causing loss and damage (L&D) to those who are unable to adapt to its impacts. Coming from a growing recognition that adaptation to climate change has limits, the concept of L&D is a relative new-comer to the international agenda on climate change. To reduce L&D and compensate for it, the United Nations Framework on Climate Change (UNFCCC) first needs to understand what these residual impacts of climate change are. However, the literature on lived-experiences of L&D is limited, especially on non-material L&D which is more difficult to measure. Using Warner et al. (2013) definition of L&D, this study first assesses what material and non-material losses and damages from the Cape Town drought have been on a group of urban-poor women farmers. Then, this research uses a barriers and enablers to adaptation framework to understand how to reduce these losses and damages. This qualitative case-study investigates women farmers' lived-experiences of L&D during the 2015-2017 drought in Gugulethu, a low-income settlement in Cape Town, to feed into broader debates on ways to reduce L&D in global south cities. Semi-structured interviews were conducted with six women farmers from the Umthunzi Farming Community and five other actors involved in urban agriculture in Gugulethu. The findings suggest that women farmers in this context are already experiencing L&D, with psychological, physical and social implications which appear to be particularly pertinent to their group. All participants had to reduce or stop farming which led to L&D on their urban agriculture benefits as well as L&D on their institutional trust towards the City of Cape Town. Most of these L&D were non-material. Some of the barriers to adapt and reduce L&D were a lack of external support (from the city and NGOs), a lack of financial capacity to adopt coping measures and a lack of knowledge on the possible coping measures and external support options. Enablers to reduce L&D from the drought were access to support from the Western Cape Department of Agriculture (DoA), higher levels of education, a diversity of livelihoods and a strong network with other farmers. In conclusion it emerged that external support from government departments and NGOs to urban-poor women farmers is important for adapting to the possibility of future droughts. The vulnerability of these women farmers in low-income areas need to be addressed at their roots. These emerging conceptual openings emphasise the importance of exploring lived-experiences of L&D to better reduce the risk of L&D in vulnerable communities. Further research is necessary on compensation for unavoidable L&D, which is beyond the limits of this research.

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Acronyms

CoCT	City of Cape Town
DoA	Department of Agriculture
IPCC	Intergovernmental Panel on Climate Change
L&D	Loss and damage
NGO	Non-Governmental Organisation
UFC	Umthunzi Farming Community
UNFCCC	United Nations Framework Convention on Climate Change
WIM	Warsaw International Mechanism for Loss and Damage

Contents

1. Introduction

1.1 Background of the study

In the past 20 years, the United Nations Framework Convention on Climate Change (UNFCCC) negotiations have focused on two main goals, mitigation and adaptation to climate change. However, the progress toward these objectives has been insufficient to avoid irreversible impacts in vulnerable countries (Simonelli 2013). Therefore, these vulnerable nations have recently asked for a third international mechanism to deal with residual climate change impacts, known as loss and damage (L&D). In 2013, the UNFCCC established the Warsaw International Mechanism to address L&D from the impacts of climate change in developing countries (James et al. 2014). L&D is thus a relative new-comer to the climate change agenda.

Much of the literature on L&D is at the international scale, looking at the UNFCCC negotiations and the Warsaw International Mechanism (Gewirtzman et al. 2018; James et al. 2014; Mechler et al. 2016). However, to reduce the risk of, and compensate for, residual impacts of climate change, we first need to understand what they are at the local level (Warner et al. 2013; Bauer 2013). Warner et al. (2013, 367) find local-level evidence of L&D from a survey of 3269 households in nine vulnerable countries "as a significant consequence of the inadequate ability to adapt to changes in climate patterns". Their study reveals different pathways leading to L&D but focuses on rural areas only. Yet, it is important to understand how climate change is affecting the urban poor, often exposed to the interplay of multiple stresses such as food insecurity and urban informality (Cartwright et al. 2012). As Deshpande et al. (2019: 167) explain:

> "…Climatic hazards in a city often intersect with inherent vulnerabilities associated with development deficits, poor governance structures and discriminatory urbanisation patterns adversely affecting individuals, households and communities, especially the urban poor".

Despite rapid urbanization taking place in the global south, there is a lack of research on climate change's impacts at the city-scale, and specifically for those with high exposure to, and low capacity for, reducing risk (Ziervogel et al. 2016). Poor women are one group that requires significant attention. They are particularly vulnerable because they are exposed to many gender-specific challenges that limit their ability to cope with and adapt to climate change impacts:

> "While poor women's greater vulnerability compared with men is partly due to their relatively limited access to resources and their resulting poverty, this is not the whole story. It also arises

> from social and cultural norms about, for instance, gendered divisions of labour, physical mobility, and who is entitled to take part in decision-making at household and community levels" (Terry 2009: 5).

Studies suggest that poor women are particularity affected by impacts of climate change that reduce water access as women are often responsible for domestic water provision (Harris et al. 2017). However, they generally have more indigenous knowledge on agriculture and water supplies and thus play an important role in coping and adapting to climate change (ActionAid 2007).

Therefore, poor women are under-studied even though they are considered as both especially vulnerable to climate change impacts and especially innovative in terms of adaptation (Denton 2002; Flatø et al. 2017). These under-studied dynamics can be better understood through investigating poor woman lived-experiences of L&D and what led to these residual impacts of climate change.

Understanding L&D at the local level is challenging because some of these "lived, embodied and place-based experiences are more felt than tangible and are typically difficult to measure" (Tschakert et al. 2017: 1). Indeed, the literature on L&D coming from scholars' growing recognition of adaptation's limits (Dow et al. 2013; Shackleton et al. 2015; Preston et al. 2013) tends to under-study the concept of non-material L&D. However, this concept is critical as it seeks to identify elements of life that are meaningful to people but are difficult to quantify and are not valued financially (Morrissey et al. 2013; Serdeczny et al., 2016). Hence, there is a need to understand more local-level experiences of material and non-material losses and damages from climate change impacts in global south cities to be able to reduce the risk of L&D for vulnerable communities. This research seeks to contribute to addressing these gaps, looking at women's lived-experiences of L&D from droughts in one of Cape Town's low-income areas and what barriers and enablers exist to reduce this L&D. In a changing climate, droughts are likely to become more frequent and severe in Southern Africa (Ziervogel 2018a), and it is thus important to understand what losses and damages vulnerable communities such as urban poor women are experiencing from this stress and what leads to L&D.

The 2015-2017 drought in Cape Town provides an interesting context to study material and non-material L&D at the local level. Indeed, during this historic drought, the city almost ran out of water (Ziervogel 2018a). Due to Cape Town's high reliance on dams, three consecutive years of drought led to a water crisis with dams' water levels as low as 20% in early 2018 (CoCT, 2018). The City of Cape Town (CoCT) implemented numerous measures to avoid taps running dry, mainly focused on demand-based approaches with water restrictions (Luker and Harris 2018). Urban poor residents depending on clean water for their livelihoods used a range of coping strategies to address water scarcity. However, these measures were not enough to avoid some L&D. It is especially urgent to understand what these losses and damages are, and what leads to those, when they affect vulnerable groups such as urban poor women. Some of these women are using water for urban agriculture (UA)

as a way to gain physical, social and psychological empowering effects. An emerging body of literature finds that UA activities provide multiple material and non-material benefits to urban poor women. These range from an increase in income and food security, to increases in dignity and empowerment in the community (Jacobs et al. 2008; Slater 2001; Ward, 2007). However, the UA field has done insufficient work on understanding the non-material benefits of growing food in low-income areas and how these benefits are threatened by climate change impacts such as droughts (Olivier et 2017). Indeed, the important benefits of UA for women farmers in low-income areas can be lost or damaged by droughts if adaptation and coping measures are insufficient. This research seeks to contribute to addressing these gaps in both the UA and the climate change adaptation fields by conducting a case-study on the barriers and enablers to reduce L&D from droughts for women farmers in low-income areas.

1.2 Problem statement

The Cape Flats (Figure 1) is a vast area (630 km2) of high-density low-cost and informal housing (Olivier 2018). It is primarily populated by poor black and coloured communities as a legacy of apartheid's racist city planning (Olivier and Heinecken 2017). The average unemployment rate in the area is 29% (City of Cape Town 2011), resulting in high rates of food insecurity. According to the last census, the rate of food insecurity is as high as 80 % in some of the Cape Flats' townships (Battersby 2011). Residents of the recent formal housing programs have access to municipal tap water in their home, while residents of informal settlements have to walk up to 50 meters to a communal standpipe to get water in buckets (Harris et al. 2017).

Figure 1. The red box in the above figure shows the area of the City of Cape Town known as the Cape Flats, located on an area of floodplain between the Table Mountain range and the Boland and Hottentots Holland Mountain ranges (Source: NASA).

The people living on the Cape Flats are subject to a wide range of stressors (socio-economic, political and environmental) which further marginalises them. As an attempt to reduce the multiple challenges that these communities are facing, some NGOs, local and national government departments encourage the development of urban agriculture by low-income households (Olivier 2018). However, research in 2014 showed that only four NGOs were providing training to over 6500 urban cultivators on the Cape Flats (Olivier and Heinecken 2017). This support is necessary as the area presents numerous challenges to grow food in gardens. Firstly, the Cape Flats has poor environmental conditions to grow food as a result of colonial and apartheid-era planning norms where the best land was allocated to white people (Battersby and Marshak 2013). The flat sandy ground on the Cape Flats has low fertility and is subject to floods, strong winds and heat waves (Olivier and Heinecken 2017). There is also a high level of vandalism in the area, resulting in many farmers getting their equipment frequently stolen (Olivier and Heinecken 2017). Therefore, UA has limited uptake in Cape Town compared to other global south cities like Maputo (Halder et al. 2018). Only about 5% of the residents on the Cape Flats practice some form of urban agriculture similar to the garden in Figure 2 (Crush et al. 2011). However, UA is often a reaction to increasing vulnerability as a result of limited livelihood opportunities in the formal economy (Reuther and Dewar 2006). Therefore, urban agriculture is still growing along with the increasing urban poor population on the Cape Flats, as UA offers benefits despite the challenges to its uptake or practice. By conducting life histories interviews with farmers

in Cape Town, Dunn found that the main motivation of these farmers were social benefits more than economic ones (Dunn 2010). Olivier and Heinecken (2017) add that these social benefits, such as increased networks, are especially relevant to women farmers on the Cape Flats due to gender inequalities. All these benefits, often non-material, are currently being threatened by climate change impacts like floods and droughts.

Figure 2. Picture of one of the interviewee's personal garden (in contrast to community gardens)

In 2017, Cape Town was in the third year of a historic drought and faced exceptional water scarcity (Figure 3). The surface reservoir-based water supply system wasn't able to provide sufficient water to the 4 million residents of Cape Town and regional agriculture (Wolski et al. 2018). Indeed, the city is highly dependent on rainwater as 98.5% of its water comes from surface water sources, mostly drawn from five major dams (CoCT 2014). While the mean annual precipitation over the city is 619 mm, it dropped to 221mm in 2016 and 154mm in 2017, leaving dam levels as low as 20% in April 2018 (CSAG 2018). Records show that the average annual temperature in Cape Town increased in both minimum and maximum of about 0.16°C per decade between 1960 and 2003 (Tadross et al. 2012). Furthermore, a trend of lower rainfall over the past 84 years is also observable over the city (Tadross et al. 2012).

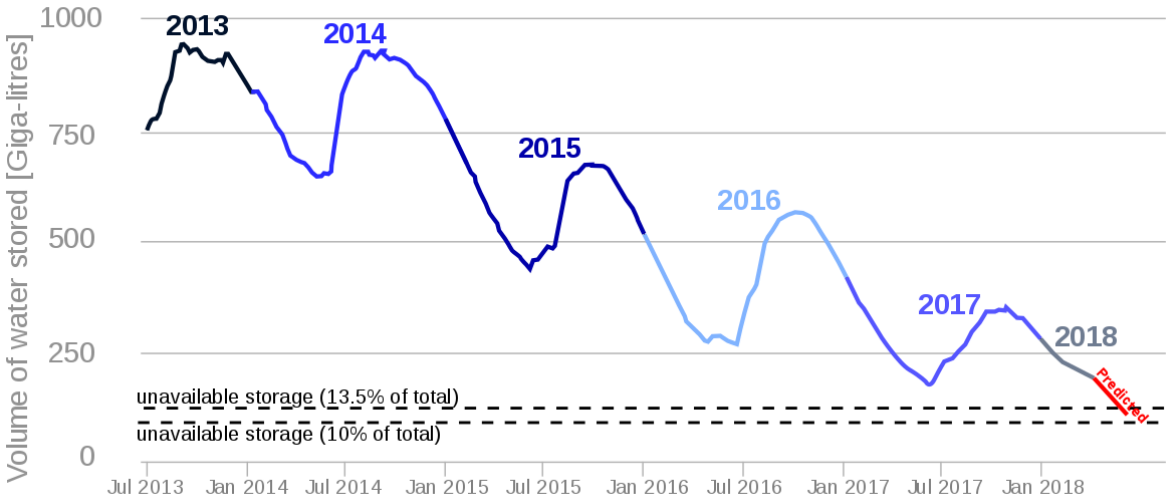

Figure 3. Ttotal reservoir water stored in the Western Cape's largest six dams from 30 June 2013 to 31 March 2018 (CSAG 2018)

The three consecutive years of very low rainfall were an important factor in this water crisis (Luker and Harris 2018). However, many factors other than climate variability, such as high levels of inequality and informality, also contributed to the crisis (Ziervogel 2018a).

The Municipal authority took some measures to avoid taps running dry, focusing on demand-side measures. The household demand was able to shift from 1.2 billion to 520 million of litres of water a day (Tavitian 2018). In level 4 water restrictions which started on the 1st of June 2017, no more irrigation with municipal water was allowed, and the maximum use of water per person per day was 100 litres. This restriction dropped to 50 litres per person per day from the 1st of February 2018, with level 6B water restrictions (GreenCape 2018). With a combination of stepped-up tariff strategies, water pressure management, leaks reparations, information campaigns and diverse other demand-driven measures, the city was able to push-back "Day Zero", the day the taps would run dry (Tavitian 2018). The City of Cape Town and the Western Cape Government also took measures to bring more water into the system including moving water from one catchment to another, bringing external water into the system and building temporary small-scale desalinization plants (Tavitian 2018). Numerous individual initiatives were also taken to voluntarily reduce water consumption, to donate, or enhance water recuperation. These reactive measures were taken because of the emergency of the situation. Longer-term strategies are now being developed to prepare the city for increasing droughts under climate change.

Otto et al. (2018) conducted an attribution analysis to assess the role of climate change in exacerbating the severity of the 2015-2017 drought. The authors found that "synthesising the results from five different large model ensembles as well as observed data gives a significant increase by a factor of three (95% confidence interval 1.5–6) of such a drought to occur because of anthropogenic climate change", and that this trend is likely to continue with future global warming (Otto et al. 2018).

1.3 Aim and objectives

In line with the research gaps discussed previously, the aim of this study is first to understand the L&D from droughts for women farmers in low-income areas, and then understand the barriers and enablers to reducing these losses and damages.

The following objectives contribute to the aim of the study:

1) Understand the economic and non-economic benefits of farming for women in low-income areas

2) Understand adapting and coping strategies to water scarcity taken by women farmers and local governments and assess the extent to which these measures reduced L&D

3) Conceptualise how this local-level case study feeds into broader debates over barriers and enablers to reduce L&D in global south cities

1.4 Organisation of the thesis

This research is organised into six chapters. The second chapter analyses the literature on UA, water scarcity and adaptation, with a focus on low-income areas in global south cities. It explains where gaps exist in these fields and then provides an overview of the concept of L&D and how it is used in this study in relation to a barriers and enablers to adaptation framework. Chapter three covers the methodology of the study, describing the case study, the data collection and analysis, as well as the limitations and ethical considerations of the study. In chapter four, the results of the study are presented through a description of the lived-experiences of water scarcity and its management in Gugulethu. The fifth chapter first analysis the participants' L&D experiences and then look at barriers and enablers to adapt and reduce L&D in low-income areas. Chapter six concludes this study, summarising the findings and implications, and suggesting further research topics in this field.

2. Framework and literature review

2.1 Barriers and enablers to adaption Framework

This research will first use the concept of L&D to understand the residual impacts of climate change on a group of women farmers in the low-income area of Gugulethu. Then, a barriers and enablers to adaptation framework will be applied to this case-study to understand how L&D can be reduced. The concept of loss and damage is emerging both in the political and the academic spheres (Tschakert et al. 2017). There is no universal definition for L&D because of its progressive conceptual complexity (Huq et al. 2013). Indeed, L&D can be difficult to measure, especially when it is non-material such as losses of cultural heritage or dignity. The UNFCCC defines L&D as "the actual and/or potential manifestation of impacts associated with climate change in developing countries that negatively affect human and natural systems" (James et al. 2014). The concept of L&D is often treated as a blended concept, yet some distinguish permanent loss from repairable damage (Taraska 2015). Tschakert et al. (2017: 3) explains that the UNFCCC also threats L&D as a blended concept but:

> "understands losses as irreversible in the sense that reparation and restoration are not possible. It proposes that losses be addressed through risk transfer (e.g. insurance) and risk retention (e.g. social safety nets). In contrast, it considers damages as reversible, through risk reduction, reparation, and restoration".

The concept of L&D can also be considered as material or non-material (Taraska 2013). For instance, loss of life is considered as a permanent non-material loss while an infrastructure destruction is considered as a material damage. Another common distinction is between avoidable and unavoidable L&D (Huq et al. 2013). The extent to which losses and damages on people's lives can be avoided is difficult to measure. The literature on L&D looking at avoidable residual impacts of climate change often understands the degree of L&D as dependant of the effectiveness of adaptation efforts (Verheyen 2012). This emerging body of literature looks at ways to reduce the risk of L&D by focusing on adaptation while other authors seek to understand how to compensate for unavoidable L&D and for L&D that already occurred (Linnerooth-Bay and Mechler 2015; Thompson and Otto 2015). The challenge of compensation is an important topic but is beyond the limits of this research. This thesis will first try to understand what L&D is through a case study and then how to reduce L&D.

This research uses the concept of L&D from Warner et al. (2013) as a lens to understand the residual impacts of droughts. They define L&D as "negative effects of climate variability and climate change that people have not been able to cope with or adapt to" (Warner et al. 2013: 369). The authors understand L&D as a residual from both negative climate impacts and adaptive measures:

> "What are the effects of climate variability and climate change that people have not (yet) been able to avoid? What are the limits and costs of adaptation to climatic changes? What happens to a household when its coping strategies are not effective enough to avoid or manage the impacts of extreme events?" (Warner et al. 2013: 369).

By linking the concepts of L&D as residual impacts with the concepts of climate variability and changes, societal impacts, vulnerability, coping and adapting, the authors are able to make sense of the problem under investigation: local-level experiences of L&D in vulnerable countries.

This thesis uses a similar L&D framework to understand local-level experiences of residual impacts of climate change for women urban poor farmers. In this research, the concept of L&D is linked to the concepts of UA, water scarcity and adaptation to understand the specific situation of women urban poor farmers not having been able to fully adapt to or cope with climate change impacts. The relationships among these concepts help to understand the complexity of women urban poor farmers' experience of a drought. Indeed, the lens of L&D interacting with vulnerability shows the conditions leading to residual impacts of droughts for women farmers in low-income settlements. As explained by Warner & van der Geest (2013: 369):

> "The empirical research on loss and damage aimed to enhance understanding of how the interaction of climatic variability and climate change with livelihoods and social vulnerability creates particular patterns of L&D today in least developed and developing countries".

In Southern Africa, the links between urban food security, urban poverty, gender and climate change have been under-studied, but "the problems of global disparity and achieving food security in a highly variable climatic context are connected and cannot be solved separately" (Ziervogel and Frayne 2011). Recognizing these interconnections could help to produce more effective policies on L&D at the local and international levels (Connolly-Boutin 2016). In this research, these linked challenges will be studied together through the Warner et al (2013) L&D framework to be able to understand the material and non-material L&D experienced by women farmers in Gugulethu during the drought.

Once L&D in this context is understood, this research will look at ways to reduce L&D by using a barriers and enablers to adaptation framework, feeding into broader debates on L&D reduction in the global south. A growing body of literature looks at barriers and enablers to adaptation to climate change (Barnett et al. 2015; Biesbroek et al. 2013; Adger et al. 2009). However, there are limited studies addressing barriers and enablers to adaptation in global south cities and the resulting L&D. For instance, Singh et al. (2017) find that informal dwellers in the city of Bengaluru, India, mostly respond to climatic risks with short-term coping strategies. In their study, enablers to adaptation include NGOs and civil society interventions while barriers to adaptation include the absence of tenureship rights (Singh et al. 2017). Ravani et al. (2013), Bauer (2013) and Deshpande et al. (2018) find similar results from their local-level case studies of barriers and enablers of adaptation in India, Nepal and Bangladesh. To better enable adaptation and overcome barriers, more local level case-

studies on these dynamics are needed. This research will use the lens of barriers and enablers to adaptation to look at local-level trajectories of women poor farmers in times of droughts, and understand what reduces L&D.

2.2 Literature review of three interlinked fields

2.2.1 Urban agriculture

An increasing number of researchers recognise the multi-functionality of UA: it can improve food security, create jobs, cool cities and keep money circulating locally (McClintock 2010). The cost and GHG emissions from food transport are reduced, the soil can act as a carbon sink and in the case of a city like Cape Town, water can be absorbed for aquifer recharge (Battersby et al. 2012). UA can also bring non-material benefits to participants such as a sense of community, a reconnection between farmers and consumers, awareness on health and environmental issues as well as therapeutic and empowering effects (McClintock 2010; Battersby and Marshak 2013; Oliver and Heinecken 2017). Yet, UA relies on water and in urban poor contexts, there is competition for this resource as high levels of inequality and the need to support livelihoods exist.

2.2.1.1. Global south urban agriculture

The policies, projects and literature on Urban Agriculture (UA) are traditionally divided into a northern and a southern vision of growing food in cities (Battersby and Marshak 2013). While the northern vision of UA focuses on its social benefits, urban cultivation in the global south is more valued for its material benefits. Indeed, UA is often framed as community gardening in the global north, mostly procuring social and community benefits such as "upliftment", "cohesion" and "community development" (Battersby and Marshak 2013). Growing food in global south cities is more often seen as a way to address poverty and food security stresses by providing material benefits to the urban poor. An example of this vision can be seen in the CoCT's Urban Agriculture Policy, used by the city to drive and justify most of their advocacy work on food security: "The City believes that urban agriculture can play a pivotal role in poverty alleviation (to improve household food security and nutrition status of people) and economic development (as economic activity it can contribute to job creation and income generation)" (City of Cape Town 2007). Battersby and Marshak (2013) argue that this framing of UA fails to understand the farmers' real motivations and benefits from UA. Indeed, compared to the non-material benefits of UA in Cape Town, the economic benefits are limited, partly because the city's market structures are insufficient to support the entry of UA's

products into existing markets (Battersby and Marshak 2013). By focusing on the material benefits of growing food and ignoring the social advantages of this practice, UA policies and NGO projects tend to have limited results in global south cities. A growing body of literature recognises the importance of non-material benefits of UA in these cities (Slater 2001; Ward 2007; Jacobs et al. 2008; Tembo et Louw 2013; Battersby and Marshak 2013; Oliver and Heinecken 2017).

2.2.1.2. Non-material benefits of urban agriculture

By investigating the lived-experiences of urban poor farmers in Cape Town, Olivier and Heinecken find that UA contributes to building social capital, which improves interpersonal relations and livelihood strategies. The authors argue that it is important to look "beyond economics and the physical benefits of urban agriculture to the personal and social benefits", as these include psychological aspects of being involved in urban agriculture like a sense of pride and accomplishment (Olivier & Heinecken 2017). Other studies agree that UA has benefits beyond food security and income generation. For instance, results from a sample of farming projects around the Cape Metropolitan Area found that almost all women-led UA initiatives in low-income areas resulted an increase in social solidarity as vegetables were donated to schools and HIV/AIDS patients (Jacobs & Xaba 2011). Tembo and Louw (2013) find that the gardens on the Cape Flats did not contribute much in terms of income, but farmers "carried on because gardening enabled them to interact socially and have created a sense of belonging and satisfaction".

2.2.1.3. Gender dimension of urban agriculture

The growing literature looking at the non-material benefits of UA in global south cities often finds that the practice empowers women in informal settlements (Olivier and Heinecken. 2017a; Jacobs et al. 2008; Slater 2001; Ward, 2007; Hovorka et al. 2009):

> "Urban agriculture is an important source of food and income throughout Africa. The majority of cultivators on the continent are women who use urban agriculture to provide for their family. Much research on urban agriculture in Africa focuses on the material benefits of urban agriculture for women, but a smaller body of literature considers its social and psychological empowering effects" (Oliver and Heinecken 2017a: 743).

By creating networks and friendships between women farmers, UA activities "counteract the isolating effect of poverty and patriarchy experienced by woman" (Olivier et al. 2017). Especially when gardening in a group, women farmers empower themselves in the community by finding comfort from traumatic experiences and getting more control over the household food consumption (Slater 2001). This could partly explain why women farmers in Cape Town give more importance to the network and social cohesion they get from UA, compared to its economic benefits (Battersby and

Marshak 2013). However, the social benefits generated by economically marginalized women are under-researched in the global south (Olivier et al. 2017).

2.2.2 Climate change and water scarcity

Water scarcity could be an increasing threat to global south cities and their UA activities in low-income areas. However, there is a lack of literature on the impacts of climate change on water scarcity, and on the impacts of water scarcity on activities such as UA.

2.2.2.1 Urban climate change impacts on water supply

Most of the literature on climate change impacts in the global south are focusing on rural areas (Birkmann et al. 2010). Urban climate change impacts are understudied, especially when they are invisible like droughts and affecting economically marginalised communities (Cartwright et al. 2012; Ziervogel et al. 2014). However, global south fast-growing cities are hotspots of high risk given their concentrations of population, their high levels of poverty and their geographic locations. For instance, a city like Cape Town is in the interplay of numerous climate change impacts such as droughts, floods, sea-level rise and heatwaves (Cartwright et al. 2012). These climate change impacts are threatening the city's water supplies, as Cape Town relies on rain-fed dams. Dr Kevin Winter of the University of Cape Town's Future Water Institute finds that the drought interval is closing leaving less time for the city to recover, and that rainfall is coming later, dropping more erratically, and often missing the catchments creating water scarcity in a city of about 4 million people (Bohatch 2017).

2.2.2.2 Urban water use

On the Cape Flats, residents are progressively upgrading from informal settlements — with communal standpipes — to newly built formal housing — with in-home taps (Harris et al. 2017). This formalisation of water consumption goes with an increase in the use of 'water management devices' in the city, which are small meters installed in homes to restrict and measure water use. The unevenness of services in this area and the increasing use of management devices create tensions between considering water as a public right or as an economic good (Environmental Monitoring Group 2014). In the Western Cape, 30 000 urban households use municipal drinking water to irrigate their crops and vegetables (Western Cape Government 2017). These households are impacted by measures such as water restrictions and water price increases during droughts that do not take UA into account. Requiring municipal water for livelihood options is challenging, especially for urban poor households. As Wilson and Pereira (2012, 3) explain, "poor households are the main target of

city-led water conservation and water-demand management strategies, which are often experienced as punitive and unjust". The recent situation of extraordinary water scarcity could increase this inequitable aspect of water access and water management in Cape Town, where many informal dwellers already have limited access to sanitation and water (Ziervogel et al. 2010). This study seeks to understand the challenges of using urban water for livelihood options for poor women in times of extreme droughts.

2.2.2.3 Gender dimension of water use

A growing body of literature suggests that "women and men often have differentiated relationships to water access, uses, knowledges, governance, and experiences" (Harris et al. 2017, 561). It is generally argued that women are particularity affected by water scarcity because women are often responsible for domestic provision of water due to gender roles. For instance, research in Khayelitsha and Philippi (Cape Flats) show that there are more women than men fetching water from communal standpipes (Harris et al. 2017). Women are also generally the main actors involved in UA as they represent 65% of urban farmers in the world (Orsini 2013). As UA requires water for irrigation, women are more often in charge of fetching it. Therefore, when urban water supplies are at risk, urban poor women relying on water for UA as a livelihood option are too.

2.2.3 Adaptation

This research will use the definition of adaptation to climate change as "a process whereby individuals and communities seek to respond to actual or expected climatic stimuli or their effects" (Mukheibir et al. 2007).

2.2.3.1 Adaptation and coping strategies

Adaptation measures and coping strategies are often used synonymously but bear different meanings. They involve different types of responses to different types of stressors (Bauer 2013). In this research, adaptation measures are defined as long-term responses to gradual climate change while coping strategies are shorter-term responses to the impacts of sudden events (Warner et al. 2013). For instance, an adaptation measure for the CoCT facing droughts would be to diversify their water supply system on the long-term, while coping measures would be short-term responses in reaction to a drought like water pressure management measures. The literature on farmers' coping strategies for droughts puts forward measures such as diversification of crops, measures to enhance water storage, non-farm-related livelihoods and changes in economic structures of households (Krysanova et al. 2008). In semi-arid areas in Southern Africa, one of the main coping mechanisms to droughts is

relying on social networks for assistance (ASSAR 2015). However, most of the literature on farmers' coping strategies focuses on rural areas.

2.2.3.2 Urban adaptation

Given the multiple challenges African countries face, long-term responses to climate change have not been prioritised in the past (Ziervogel et al. 2016). Adaptation planning is therefore limited, and mostly happening at the national level rather than at the city-scale (Mukheibir et al. 2007). However, the literature on urban adaptation in Africa is growing (Ziervogel et al. 2016). Research shows different challenges that urban adaptation faces in African cities such as political instability or a lack of local climate data (Taylor et al. 2014). In Cape Town, Mukheibir and Ziervogel (2007: 156) find that "low local human capacity to undertake this kind of planning, and the limited knowledge and understanding of climate issues at local and municipal level are some of the more obvious obstacles", in addition to limited financial resources, competing priorities, the short political life of decision makers and the absence of a legislative framework.

2.2.3.3 Gender dimension of adaptation

Women and men are affected by, and respond to, climate change impacts differently due to gender inequalities (Denton 2002; Terry 2009; Ngigi et al. 2017). For instance, Eriksen et al. (2005) conducted a case-study in drought-affected smallholder communities in Tanzania and Kenya and found that households whose diversified their livelihood options tended to do better adapt to climate stress. However, women's livelihood options were very limited compared to men's as women faced a lack of access to financial capital, gender norms that excluded them from some livelihood activities and reproductive work burdens that limited their working time. The fact that women tend to be most vulnerable to, and have access to less resources to face, climate change impacts is a well-established argument in the literature and in adaptation projects (Bryan et al. 2016). However, poor women should not be seen as powerless victims of climate risk. Terry (2009) highlights the agency that poor women have in adapting to climate change thanks to their gendered indigenous knowledge. Terry (2009: 14) explains that while "the extent to which poor women and men can exercise resourcefulness in response to climate impacts should not be romanticised", women often have an especially important role to play in adaptation.

2.2.3.4 Limits to adaptation

In the climate change literature, L&D is an emerging field coming from scholars' growing recognition of adaptation's limits (Rockström et al. 2009; Adger et al. 2009; O'Brien et al. 2010; Dow et al. 2013;

Preston et al. 2013; Shackleton et al. 2015). The concept of an "adaptation frontier" comes from the emergence of two concepts in the climate change literature (Preston et al. 2013): Rockström et al. (2009) introduced the concept of a "safe operating space" for human society looking at the different biophysical boundaries in the Earth system, while the "social limits" to adaptation emerged from the recognition of the social dimensions of adaptation limits (Adger et al. 2009; O'Brien et al. 2010). Some adaptation limits have been clearly identified in ecological systems, like species extinctions. However, very little is known on social systems' limits to adapt to climate change and their consequences in terms of permanent losses and reparable damages to people's lives (Dow et al. 2013). By looking at the lived-experiences of L&D, this research will show local-level examples of social limits to adaptation.

2.2.3.5 Non-material loss and damage

The non-material (or non-economic) L&D concept is especially understudied as they are difficult to measure. Yet, Non-material L&D is of importance as it seeks to identify elements of life that are valued by people but not financially and are difficult to measure (Morrissey et al. 2013; Serdeczny et al., 2016). The UNFCCC explains that non-economic L&D occurs at three levels: "For individuals, a noneconomic loss may be a loss of life or health; for society it could be the territory or cultural heritage; and environmental non-economic loss could be biodiversity or ecosystem services" (Simonelli 2013). The UNFCCC proposes to address L&D through risk transfer, risk retention, risk reduction, reparation and restoration (Tschakert et al. 2017). However, non-economic L&D such as loss of dignity or loss of social cohesion are difficult to measure and compensate for under these mechanisms. The WIM recognises that there are gaps in the knowledge about non-economic losses and extreme weather events (Huq et al. 2013). Therefore, there is a need to understand more local-level experiences of material and nonmaterial L&D from climate change impacts. These impacts have significant non-material consequences on the local level that are rarely considered when thinking about compensation. To avoid and compensate for L&D, we need to understand what it is first at the local level.

3. Methodology

3.1 Case-study description

This qualitative research uses a case study approach to look at women farmers' lived-experiences of L&D in Gugulethu. According to Simons (2009: 21), a "case study is an in-depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy, institution, program or system in a "real life" context". Therefore, different actors of UA on the Cape Flats were consulted to understand women farmers experiences of loss and damage in low-income areas. The case study focuses on the Umthunzi Farming Community (UFC) as it is one of the rare market platforms where small-scale farmers on the Cape Flats can sell their harvests. It consists in a network of 45 urban farmers across Gugulethu, Nyanga, Mitchells Plain, Khayelitsha and Philippi (Figure 4) working together in the preparation of weekly vegetable baskets marketed through a Whatsapp group, in different locations in Cape Town.

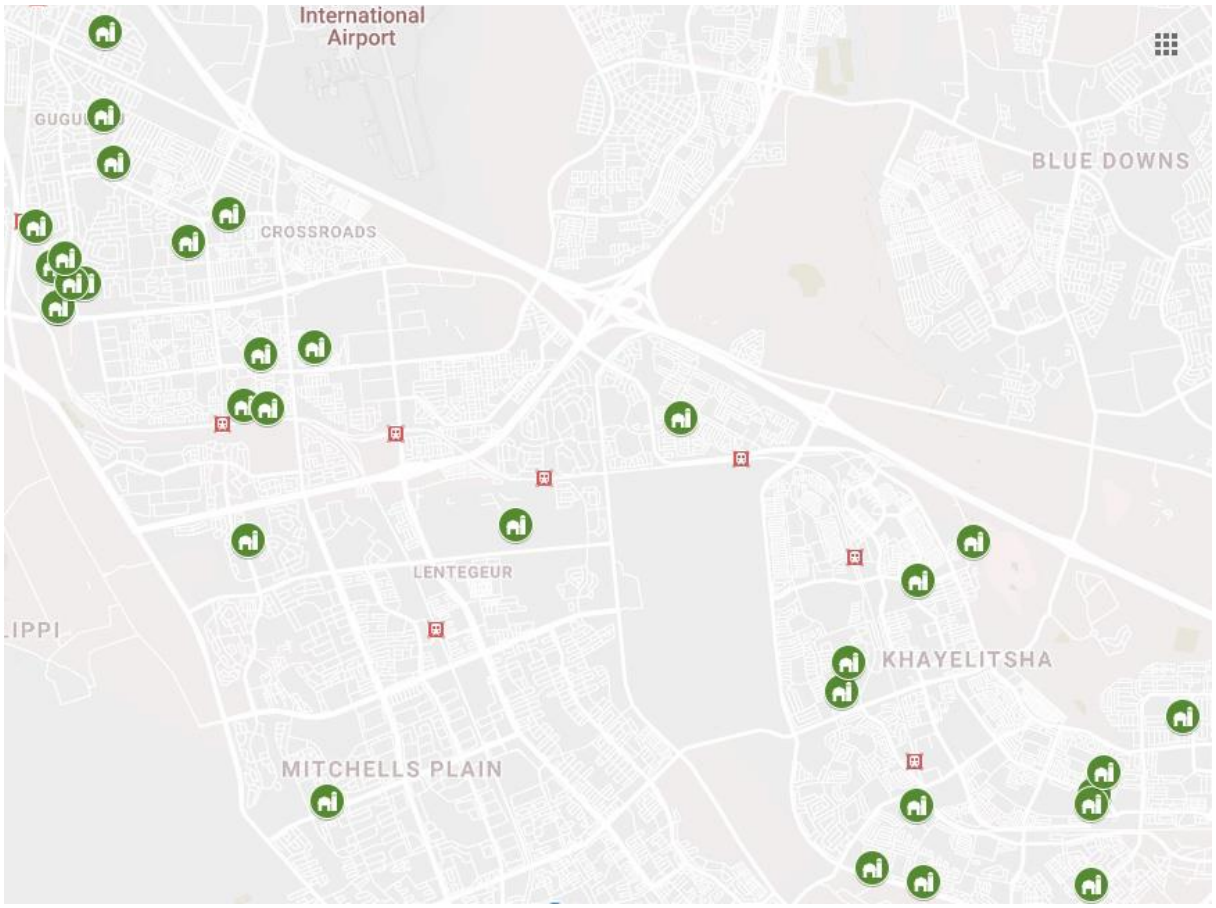

Figure 4. The Umthunzi Farming Community's network of gardens. Each green point represents a community garden or an individual garden (UFC 2018)

The initiative was established in March 2018 by two volunteers as an emergency market platform after the sudden collapse of the NGO Harvest of Hope's weekly vegetable basket system, for

unknown reasons. Many farmers that were selling vegetables trough Harvest of Hope as a livelihood option, suddenly lost their main market platform. UFC was therefore created very recently and in an emergency, to support farmers on the Cape Flats. These factors explain why the UFC initiative has evolved very fast during this research. At the beginning of the research, UFC was an informal group, but it developed to an official business at the end of July 2018.

The UFC vision is to create a more sustainable, ethical and transparent local food system, thereby increasing the sustainable livelihood of farmers and access to nourishing food for all. The weekly basket system supports farmers to grow, sell and eat organic (non-certified), seasonal and locally-grown vegetables; as well as create awareness to customers. Indeed, customers are connected with farmers of the UFC through a Whatsapp group and through occasional meetings. The customers are sometimes invited to volunteer in the gardens or at the weekly vegetable basket packing day (Figure 5) to encourage links between farmers and customers and create a more transparent food chain.

Figure 5. UFC vegetable baskets during a vegetable packing day (Maike McNeill 2018)

The gardens range from 1-meter square backyards to 200-meters square community gardens. All farmers use some vegetables for their own households and sell some vegetables through the UFC market. Most of the farmers knew each other from the previous farmers' group, before the UFC initiative. There is a majority of women in the group, and most of them are more then 40 years old.

3.2 Data collection

Semi-structured interviews and participant observations were the two main data collection methods used in this research to understand the L&D lived-experiences of the participants.

3.2.1 Semi-structured interviews

Semi-structured interviews were conducted between September and December 2018 as the main data collection method. Participants were selected according to the case-study needs on a criterion-based strategy using the criterion of gender (woman), location (Gugulethu), and water sources (municipal or groundwater) (Appendix 8.1). The two UFC organisers helped me to identify the potential interviewees in their community according to these criterions and to the ease-of-access of these potential participants. I was connected to these potential informants through the UFC network, by participating in "vegetable basket packing days" every Thursday in Gugulethu. The case-study mostly needed interviews with women farmers in Gugulethu as the research focuses on their lived-experiences of L&D. Talking about material and non-material benefits of UA and material and non-material L&D, is quite personal and requires a certain level of ease with the researcher. By volunteering at the Umthunzi Farming Community, I met weekly with six women farmers from Gugulethu before starting the interviews, which left time for the participants to be more comfortable with my presence. One male farmer working with a group of women farmers was also interviewed to have some insights into his own and his colleagues' experiences of the 2015-2017 drought. A women farmer's daughter was also interviewed to get an external vision of the benefits of farming for her mother, and how the drought had affected those benefits for the whole household. The insights from the two organisers of the Umthunzi initiative were also considered as important for this research. They were both interviewed to have a more general understanding of the Umthunzi Farming Community challenges in times of water scarcity. For this research, interviews with the Western Cape Department of Agriculture (DoA) officers and the City of Cape Town officers would have helped me to understand the situation but only one officer from the DoA answered to my request.

The individual interviews were mainly conducted at the Lotus Park Community Center, Gugulethu, where the vegetable baskets packing day took place weekly. A few interviews were also conducted in the participants' vegetable gardens in Gugulethu, as I was invited to visit 3 participants' gardens. The interviews ranged from 20 minutes to one hour. First, I gave an explanation of the research and the research process to the participants. Then, the consent form was presented to the informants (Appendix 8.3). The interviews were recorded for me to be able to engage fully in the conversations. Finally, the interviews were transcribed on the same day to keep the information fresh in my mind. The interview questions can be found in Appendix 8.2.

3.2.2 Participant observations

Volunteering at the weekly vegetable basket packing days for four months helped me to observe my participants and other women farmers from Gugulethu and different locations on the Cape Flats. I had informal discussions with the group of women farmers and with individual informants during these meetings which gave me a better understanding of the benefits of UA, the challenges of the recent drought and the women farmers lived-experiences of L&D. I got invited to visit three vegetable gardens in Gugulethu with three different farmers. I observed the coping measures taken by the participants to save water such as greywater use or a borehole installation. These visits also permitted me to have informal discussions with women farmers' family members on the role of UA in their household. Finally, using only participant observations for the first month of the research helped me and the informants to be more comfortable in having recorded discussions when we started the interviews.

3.3. Data analysis

This research used a thematic analysis to interpret the data from the interviews. According to Braun et al. (2014), thematic analysis is "a method for identifying, analysing and interpreting patterned meanings or 'themes' in qualitative data". I followed part of the authors step-by-step guide to do a thematic analysis. First, I familiarised myself with the interviews by re-reading them several times. Then, I coded the information in the interviews by labelling them in a Word document's table with a short sentence that captures its key analytical idea. I then clustered these codes under themes, which have broader level of meaning than codes.

The four emerging themes from this thematic analysis were:

1) Benefits of urban agriculture
2) Impacts of the drought
3) Responses to the drought
4) L&D occurring despite all measures
5) Expectation for the future of urban agriculture

These themes helped me to understand the experiences of the 2015-2017 drought by woman farmers in Gugulethu. As this research focuses on lived-experiences of L&D, the voice of woman farmers has a central role in chapter 4 (Results). The themes are presented and discussed in chapter 4 and analysed in chapter 5.

3.4 Short film project

A short film project was developed during this research to be able to present the result of this case-study to the participants in an accessible way. The 5-minutes long video is a portrait of two farmers talking about their lived-experiences of UA during the 2015-2017 drought in Cape Town. The video aims to show results of this research in an accessible way, to the participants, their families and the larger UFC. The two interviewees are kept anonymous as no personal information that could make them identifiable are given in the short-film. Both were explained the nature of the short-film project and both signed a consent form to give the researcher permission to use recorded and filmed interviews. The film project was presented to the two farmers for validation while being edited. Finally, a screening will be organised with the UFC and their families in Gugulethu, followed by a discussion on the results of this research in February 2019. The link to this video is given in Chapter 4.

3.5 Limitations

Due to the length and time constraints on this research project, only a limited number of actors were interviewed. Semi-structured interviews on the topic of lived-experiences of L&D is time consuming as they demand a lot of time spent with the informants beforehand. Furthermore, I could not reach some of the women farmers that completely stopped farming as they got isolated from the UFC community, even though their testimony would have been valuable for this research. The voices of city officials would also have been pertinent to understand the context of UA in Gugulethu, but several didn't accept to be interviewed.

This research is based on a single case-study and thus cannot be generalised to different contexts. Case study approaches are often criticised for this inability to generalize (Flyvbjerg, 2006). The goal of this study is to contribute to the literature around UA and L&D in low-income areas, acknowledging that further research still needs to be done with different research methods.
Finally, I am unable to eliminate either my own bias or that of the interviewees (Flyvbjerg, 2006). Indeed, case-studies are known to include bias in the researcher's expectations of results, favouring some information in the selection of interviewees or in the selection of data used in the research to support the theory. Research participants can also choose to give some information over other and thus express some bias.

3.6 Ethical considerations

This research has received the approval from the Faculty of Science Research Ethics Committee. Furthermore, I asked permission to the Umthunzi Farming Community before conducting research in

their community and made the nature of the research clear to participants. Consent forms were presented to interviewees to be signed before the recording (appendix 2). Informants are only identified by their activity or first name. All personally identifying information wasn't used, to keep the informants anonymous. The researcher will report back to the participants on the results at a vegetable basket packing day, where all of the UFC gather weekly. A discussion will also be organised after the screening of the short film project that took place alongside this research.

4. Results: "We are all in the same boat, so we just want to help each other!"

The results paint a complex picture of the impact of the 2015-2017 drought on small-scale women farmers in Gugulethu. The participants experienced the drought differently from each other as they had different benefits from farming, sources of water, adaptation strategies and external support. In order to understand better the L&D lived-experiences of women farmers in Gugulethu, the story of two participants are shown as examples in a short video that was produced during the fieldwork: https://www.youtube.com/watch?v=mQITopTMads&feature=youtu.be

This chapter describes the participants experiences of the drought through five emerging topics from the interviews: 1) Benefits of UA, 2) Impacts of the drought, 3) Responses to the drought, 4) Residual impacts of the drought, and 5) Expectations for the future of UA.

4.1 The many benefits of urban agriculture

Motivations to start farming and benefits gained by this activity in Gugulethu are numerous but quite similar across the group of farmers interviewed. The UA benefits that were articulated by the participants were mostly social and not economic. However, a few participants use UA as their main livelihood option and turned their gardens into a profitable business.

4.1.1 Material benefits: saving money and getting an income

In terms of UA's material benefits, participants noted two main advantages: saving money as they all use their vegetables for their own household's consumption and getting an income for their vegetables (through the UFC). However, there is a difference in the extent to which the vegetables are used to be sold or eaten by the farmers' households. This difference ranged from one interviewee saying that she mostly uses her vegetables for her own household and only sells her vegetables if there are extras, to an interviewee that produces and sells many more vegetables than his family consumes. Depending on the farmer's socio-economic conditions, the garden's size and the farmer's business ambitions, UA's material benefits were primarily to save money or to get an income.

The main material motivation to start UA across the participants is to get free food. As one of the interviewees stated, "By planting vegetables, I save money" (Vuyelwa). Instead of buying vegetables in the supermarket, participants chose to grow vegetables in their garden to save on their food expenses. One participant explained that he encourages unemployed people to start their garden to save money on food:

> "There are still more people coming now because employment is going down so they need to help them and their families so we started advising them like: you can do a small box there in

> the corner instead of to do nothing and then you have 2-3 spinaches. […] At the end of the month, you get something" (Manelisi).

Two participants mentioned hunger as a main motivation to start farming. They suggested that nutritious food was not affordable before their UA activities. The two farmers underlined their willingness to support their family and neighbours by growing food, making the needed quantity of vegetables accessible. These motivations link to another participants' vision of UA as a means to fight food insecurity with a bottom-up approach:

> "If you look at the situation now, there is people that starve because there is no food. […] We cannot sit and depend on the government anymore because we've being doing that for years and years and the situation is getting worse. I feel the time has come for us now to start pushing from bottom-up now because government don't want to change" (Magda).

For urban-poor households, growing vegetables is thus a way to save money to be spent on other food items and therefore increase their food security.

Even if the initial material motivation to start UA for a majority of participants is to get food for free, the motivations to continue farming sometimes shift to get an income. UA can also be a source of extra income or even the primary source of income for a household. One of the participants explained that she continued farming mostly because her UA activity "is more on the business side. We do benefit because we don't have to go and buy (vegetables) but mostly it is for the family business. As a source of income" (Vuyokazi). This woman farmer has the ambition of expanding her UA activity and the incomes generated with it to use it as her household's first source of income. However, out of the seven farmers interviewed, only one makes a living from this activity, for now. One interviewee who has been farming for five years without getting an income from it said: "It's the first time I get an income from my veggies" (Nopummela). Motivations to start or continue farming can also be non-material, which was often the situation described in this case-study.

4.1.2 Non-material benefits: community feeling, therapeutic effect and health benefits

The interviewees identified numerous non-material benefits gained from UA in Gugulethu. The notions of helping each other to grow food and giving back to the community are strong common perceptions in this case-study, along with therapeutic effects and health benefits.

The participants know each other from before the Umthunzi vegetable basket market, from workshops organized by the Western Cape DoA and from NGOs like Harvest of Hope or Seeds for Life. Through these interactions, the farmers developed a strong network of solidarity. Observations during vegetable basket packing days showed the solidarity of the community. For instance, I saw a woman farmer giving some free seedlings to another woman farmer that just started UA. One of the

interviewees explained that she has informal meetings weekly with other women to share UA challenges: "We decided to be a group so that we talk about the problems that we have in the gardens" (Vuyelwa). She underlines the solidarity that especially exists between woman farmers and what benefits she gets from these meetings: "Other women are really empowering me" (Vuyelwa). She adds that woman with young kids are especially encouraged to have vegetable gardens:

> "If I have a lot of seeds or seedlings, I can give a lot to someone who hasn't got. My next-door neighbour is struggling, she started to farm 2 or 3 months ago, I do help her. You must go and help. And you must encourage other people to do farming. We encourage other people who hasn't got creche for babies or children to do the farming so that they don't go to the shop every now and then to buy vegetables, they take them from their garden." (Vuyelwa).

A young mother interviewed explains that: "You can never go to work with a child. Here, I can do that. He (the baby) gets to spend more time with his granny, his mother and his uncle so it's a win-win situation" (Vuyokazi). As childcare is a responsibility that falls to women (Bak 2008), small-scale UA in Gugulethu seems to help mothers with minding children, saving money on childcare, as well as a source of income, food and family time for the children.

There is a solidarity between farmers, but also at the scale of the wider community. Indeed, the participants mentioned the willingness to give back to the community. This can be in terms of vegetables, as a young woman specifies about her mother's UA activity: "The community benefits as well. When we get the veggies, she goes and give some out to the community" (Vuyokazi). Giving back to the community can also be in terms of knowledge, as a woman that created a vegetable garden in a school for children with special needs testifies:

> "All my knowledge, I take back to the community. […] I give back to the children just by volunteering there, teaching them basic plant production, teaching them how to start their vegetable garden. To equip them so when they leave the school at the age of 18, at least there will be a platform for them, when they go job hunting, they can say they have done practical things. So yes, the passion started there (Magda).

An UFC organiser explains that these empowering and networking effects of UA are contributing to the social cohesion in Gugulethu (Kim). These non-material benefits of UA are often more valued by the farmers than the limited economic benefits gained by growing vegetables in low-income areas.

One of the participants' motivation to start farming came from a traumatic experience: "I started farming in July 2012, just after my baby daughter passed away. I felt very lonely. I wanted to do something" (Vuyelwa). She used UA as a way to avoid feeling lonely: "You know, when I am in my garden, I feel happy because I talk to my plants, I don't feel that I'm alone" (Vuyelwa). Another interviewee testifies:

> "It's like therapy. When I get up in the morning, the first thing I do is going to the garden, checking on my veggies, and speaking to them, I say: Come on now, what's up? Why are you so slow? [laughs] Taking care of them like little babies" (Agnes).

These two participants get very limited income from their garden. From their testimony, the therapeutic effects of farming seem to be the most important benefits grained from UA.

Some participants didn't eat many vegetables at all before starting UA: "I changed my diet completely. I eat more veggies. I love veggies more now that I am involved in the garden, so it did help a lot in terms of my diet" (Vuyokasi). Some interviewees ate vegetables before farming, but not as diverse and nutritious as what they grow in their gardens. One of the UFC organisers confirms that the farmers from the community grow a large variety of vegetables, often very nutritious and organic, even if non-certified (Emma). One of the main informants explains the health benefits that she gets from growing organic vegetables in her front yard:

> "I wanted to see my lifestyle changing because I'm an old lady, with diabetes, hypertension, and I've got arthritis as well but since I eat organic vegetable, everything is fine. I don't even go to the doctor every now and then" (Vuyelwa).

She adds that gardening is also physical exercise and that it is thus good for her health to be active (Vuyelwa). Another woman farmer explained that since she started farming organic vegetables, her sick husband is in better condition (Nopummela).

One of the participants explains how hard it is to change food habits and convince people to start vegetable gardens:

> "Especially in communities, we have this mindset that a healthy diet is expensive, and we can't afford it. […] Eating healthy food, especially organic food, […] it's not just cost effective, it's a healthy lifestyle and it is accessible" (Magda).

4.2 The negative impacts of the drought

The main challenges in UA for the participants before and during the 2015-2017 drought are a lack of clean water, a lack of shelter (shade) and vandalism. The recent drought exacerbated these challenges, forcing some farmers to reduce or stop their UA activity. A few farmers who used municipal water saw their water bill increase; other farmers who used well-points could not irrigate their garden because these sometimes ran dry during the drought; heatwaves and strong winds killed some crops; city officials checked on their gardens and restricted the watering; and finally, there was an increase in acts of vandalism, such as boreholes being broken and water being stolen.

4.2.1 Material impacts of the drought: higher water bills, less income from farming

A few interviewees explained that they had to reduce or stop farming, and therefore go to the supermarket to buy vegetables: "I bought a lot of veg from the supermarket because I had no vegetables. And I was not happy about it. I don't wish drought would come again!" (Vuyelwa). Other participants spent more money on their water bills to continue farming:

> "There are old farmers that cannot carry the water so they have to stop farming or pay for municipal water. They continue farming because they need to eat, but they pay more. […] I used to use tap water but the bill became high to 8000 per year" (Nopummela).

One participant also had to pay a higher electricity bill for the use of their borehole (as water needs energy to be pumped) because a car washing business next to the community garden where she farms stole some water from the garden's borehole at night (Yoliswa).

Due to the 2015-2017 drought, some Umthunzi Farming Community members had to reduce or stop farming and therefore, reduce or stop selling vegetables through the weekly UFC basket system (Kim). One of the participants explains why she couldn't sell as much vegetables as she was expected:

> "Fortunately for me, I had my well-point but it doesn't mean I wasn't affected by the drought. Because the temperature was so high, and we had strong winds and even that destroyed the garden, because I lost big time, I had to start over, on the 16 of January my (water) pressure just dropped with the drought. You need water from below to get water. And at that time there was not enough water so even if my pump was working, I didn't suck enough in order for me to irrigate my garden" (Vuyokazi).

4.2.2 Non-material impacts of the drought: worry feeling and decrease in health

One of the main non-material impacts of the 2015-2017 was the feeling of worry that the drought generated: "We had drought […] early this year. It was very difficult. I couldn't plant anything, and I was worried because I am used to (plant). And it was not nice to see my plants dying" (Vuyelwa). A women farmer explains that she got worried after hearing about the water crisis on TV, the radio and letters from the CoCT: "But even now that the drought is not that bad, I still tell myself: save water, save water, save water, save water" (Agnes).

Another important non-material impact of the drought was on health. Not only did the participants generally have less vegetables to eat during the drought, but they also had to eat non-organic vegetables or other food-stuff instead: "I planted few things. So, I had less vegetables to eat" (Magda), "I bought a lot of veg from the supermarket because I had no vegetables" (Vuyelwa). Therefore, the drought affected their diets, the quality of their food and their health.

4.3 Responses from farmers to the drought

4.3.1 Governance interventions

Interviewees suggested that most support in times of drought seems to come from the Western Cape DoA and not from the CoCT. The CoCT water interventions during the 2015-2017 drought actually affected the farmers more than it helped them to adapt to water scarcity, as we will see in the testimonies.

Two participants explained their interaction with city officials acting as "inspectors" to save water during the drought:

> "In our townships we have the problem of people that come each and every time and see what you're doing around the garden and they see if you are using municipal water, because they ask: How do you manage your garden like this? Why your garden is always wet? Then, you must explain. Then, they see your bills as well and they say: No, you are using municipal water rather you can limit. You are not supposed to use municipality water." (Manelisi).

Another farmer describes the tensions between the community and the city officials:

> "By the time of drought last year, it was very bad because we didn't have water because there was that limit of municipality water that we can use per day and if they (city officials) saw you using the pipes they come and chase you. They came to us and chased us, they told us they are going to arrest us if they see us, we must use the buckets. And it all made us angry because they would let those people wash the cars. And we were trying to make food for our children. So it was very hateful" (Yoliswa).

The Western Cape DoA officer interviewed confirmed that: "Farmers are scared to use municipal water because they will close the tap if they don't pay. Price increased during the drought" (Provincial officer Ayanda). Indeed, some farmers suffered from the water price increase:

> "They changed the tariffs. We pay so much, but we are still using the same, we are not using more. You can try to talk to the cash office, to the councillor but I don't think they are going to bring it down because that's what they do with everyone". (Washiela).

Participants were also requested by the CoCT not to irrigate their garden by letter: "They don't allow us to irrigate gardens. It's a letter from city councillor. They tell us how much water must I use and how to use it. They don't want us to water gardens" (Nopummela). However, this informant managed to negotiate this restriction with the CoCT by explaining how important her garden was:

> "The city officials warned me that they would close the tap water if I use too much water. I told them I can't stay without water because of the garden. They said I must write a letter to the municipality and my husband must sign it, to give a proof that he is sick. The garden water must be on. So they didn't close the tap" (Nopummela).

The participants mostly described interventions from the Western Cape DoA as supportive during the drought:

> "Agriculture helps us with water, they support the people with tanks, they also give us advise that we should use grey water, that we don't need the whole garden to be wet, that we can use water straight to the plant. People from Agriculture organize workshops in agricultural offices" (Manelisi).

The Western Cape DoA officer interviewed testified that they provided rain water tanks to five farms on the Cape Flats: "We brought water to five farms during the drought. Big tanks." (Provincial officer Ayanda).

4.3.2 Individual coping strategies

The CoCT and the Western Cape DoA's responses to the drought exacerbated or reduced water scarcity for urban farmers, but these measures were not enough for some participants. Most of them did not prepare for droughts on the long-term, but rather adopted short-term individual coping strategies once the 2015-2017 drought occurred to try to keep farming.

One farmer explained that she changed her water source during the drought:

> "I used to use tap water but the bill became high to 8000 per year so I stopped using that water. So we use now wheelbarrows and we fetch water from another street, there is a pump. So we have to carry it now. It is too far. It takes half an hour. 2 x 20 litres in the wheelbarrow. 3 times a week" (Nopummela).

Most of the farmers also started using grey water during the drought. These changes in the main source of water used for irrigation for the seven farmers interviewed are reflected in Figure 6.

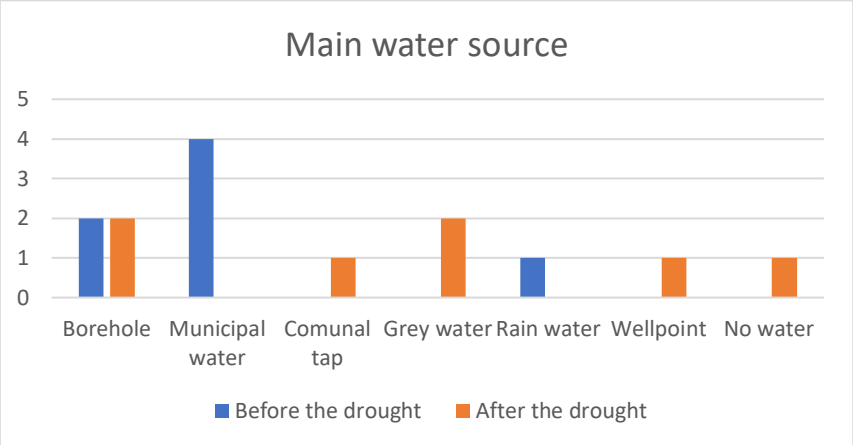

Figure 6. Water source changes during the drought.

We can see on Figure 6 that the participants using municipal water or rain water as a main source of irrigation had to change to alternative sources (one invested in a wellpoint, another fetched water

from a communal tap, two used grey water). However, the farmers using boreholes seemed less affected by the water scarcity.

One woman put in place extra coping measures to keep the soil moist for longer and save water:

> "Last year I thought the drought is not over yet, and I realized last year that I had to put things in place so this year there is a shade cloth, I also decided to put more cover crop plants to protect the soil, they are in between my veggies, I also have buckets in the garden. The plan was to convert to drip irrigation, but when you have a pump you cannot have drip irrigation. It pushes the water too fast" (Magda).

One of the farmers had issues with her wellpoint during the drought, so she asked the Western Cape DoA for help: "I asked the Department of Agriculture to give me a bigger pump. And they did" (Magda). As the first layers of soil were dry, she was able to pump water from deeper thanks to this intervention during the drought.

A group of farmers also asked the Western Cape DoA to repair their borehole in the community garden where they farm, during the drought:

> 'This borehole is coming from Agriculture. They put it last month and also this section of greenhouse, there. They put it last month because of the drought. We already had a borehole but now, because of these youngsters, the thieves came and stole it, so we swapped it for here, and we put it inside the container for protection" (Manelisi).

One participant explained that the group of woman farmers she works with and herself were watering their communal garden after office hours, when the city officers couldn't check the gardens anymore:

> "What we've done before they cut our water is that we come later in the garden, by six or seven. We were stealing because we had no ways. We would go there and open our pipes so that the veggies could drink" (Yoliswa).

Therefore, these farmers kept irrigating their garden illegally and despite the city officers' threats.

4.4 L&D occurring despite all measures

4.4.1 Loss of urban agriculture's benefits

The external support from the Western Cape DoA and the individual measures taken by farmers to face the drought were not enough to prevent some losses and damages to their UA activity. Indeed, all participants reported that they had to reduce or even stop farming at a certain point during the drought. The Western Cape DoA officer confirms that "some farmers had to stop farming, especially vulnerable, poor farmers that farmed for food security" (Provincial official). Others had to reduce their UA activity: "The plants did not survive because there was no rain, so we had to limit, rather harvest half of the garden" (Manelisi). By reducing or stopping their UA activities completely, the

participants experienced some losses and damages in their vegetable gardens which impacted all the material and non-material benefits their gained from their gardens.

4.4.2 Loss of institutional trust

Interviewees expressed a loss of institutional trust, mostly towards the CoCT:

> "I had the support of the city but since last year with the drought, they don't, there is no budget for gardens, they stopped and then what they did, the money that was allocated to gardening, they used that to improve the dams and everything except gardens, they are not interested in gardens, they don't fund gardens. They do nothing for gardens because they say they need to use the money for something else" (Magda).

Another participant explained why she was frustrated with the city's sub-council in Gugulethu:

> "We have an old meter, (the CoCT officials) they've never changed it. They just cut that pipe that was putting the water inside our garden. So we can't do anything now. So I went there (Gugulethu sub-council) with our letter, we've got our letter that complains about the water. They said they will change our meter and give us the new one. But they never come." (Yoliswa).

When asked how the participant interacted with the CoCT on his water issue, he answered:

> "Sometimes the channels go busy, so we didn't get a chance to go negotiate with them. I am just waiting for the bills at the end of the month. Sometimes it's not easy because they will say go there, go to that door, go to that door and you are tired at the end of the day because you come back with empty answers from them" (Manelisi).

Therefore, at least three informants expressed some kind of frustration and loss of institutional trust toward the CoCT during the 2015-2017 drought. These testimonies are analysed further in the next chapter. The participants thus experienced diverse L&D on their benefits from farming and on their institutional trust (Figure 9).

Figure 9. Main L&D for seven urban farmers in Gugulethu

4.5 Expectation for the future of urban agriculture

4.5.1 Expectations from city/government

Four farmers expressed the hope that related directly to the fact that they were provided with boreholes by local authorities. When they were asked about farming under future droughts, one of them said: "If there could be drought again, I would like to have the borehole before the drought so that if there is the drought, I don't stop at all to do the farming because I like it" (Vuyelwa). The Western Cape DoA officer confirms that "Borehole is a solution, we only need to dig 10 meters down. We have a lot of underground water" (Provincial officer).

However, the officer affirms that "the government has no interest in this type of farming, the gardens", and therefore, "UA on the Cape Flats is threatened" (Provincial officer). A farmer also expresses a pessimistic expectation from the CoCT: "I'm sure there is much that the city can do but there is no interest" (Magda). Thus, there is a general perception of a lack of support for UA from the CoCT in times of drought by the participants.

4.5.2 Water supply preparation

Two farmer taking climate change into account, decided to prepare for future droughts by themselves, planning on investing in wellpoints, borehole, drip irrigation systems or even hydroponic gardening:

> "That is all the things I try to put in place regarding shooting droughts, if we have another drought coming our way, which we expect because we can see with the climate change, things

> are different, your summer is not really a summer and your winter is not really a winter so it's very confusing even for the plants. They are seasonal plants. Some of them don't even grow now because they are confused" (Magda).

While one farmer seemed to think there would be an increase in droughts with climate change, another expressed the hope that droughts won't happen again. Finally, the provincial officer affirmed that the city was "not ready for more droughts" and that "farmers must stand up" (Provincial officer). He suggests that farmers ask for support from the government in order to save UA from future droughts.

5. Discussion: reactive responses versus long-term resilience

The interviews and observations during this case-study's fieldwork showed a complex picture of L&D in Gugulethu. It also pointed to what the barriers and enablers to reduce L&D from the 2015-2017 drought for women farmers in Gugulethu might be. This chapter first analyses the data using the L&D concept to assess how residual effects of climate change are experienced by participants. Then, a framework is used to explore barriers and enablers to adaptation to understand how loss and damage could be reduced. This feeds in to broader debates on ways to reduce L&D in global south cities. Compensation for unavoidable and past L&D is beyond the limit of this thesis but represents an important area for future research.

5.1 Lived-experiences of loss and damage

While participants experienced the 2015-2017 drought differently from each other, all of them encountered some L&D. To different degrees, the seven farmers experienced L&D related to the benefits they gain from UA, and on their institutional trust towards the CoCT. Figure 7 shows the general trajectory of the farmers' benefits of UA during the drought:

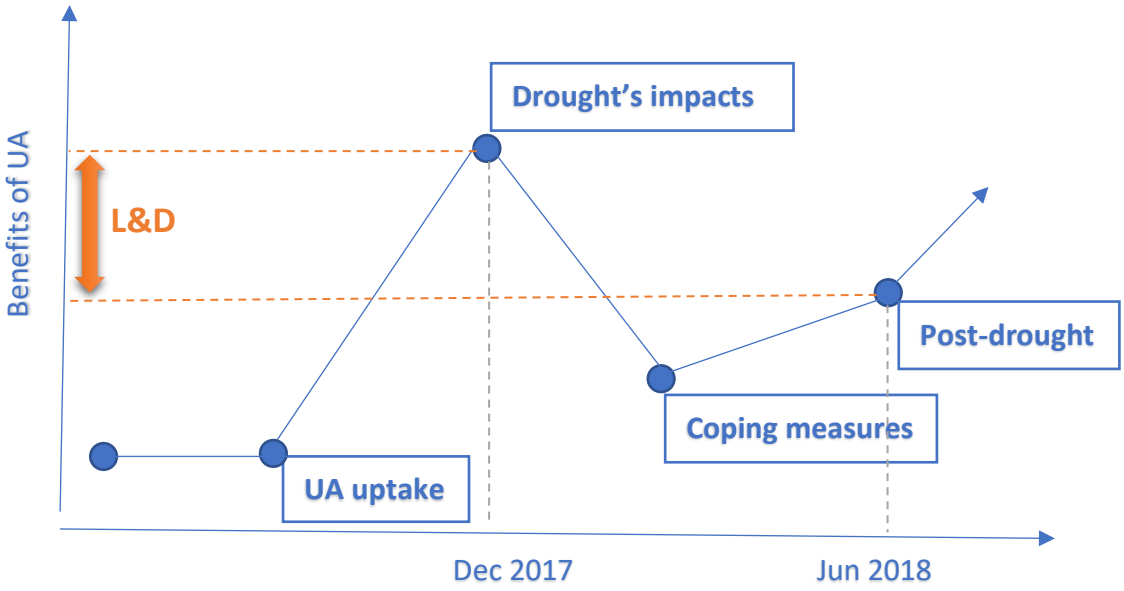

Figure 7. Benefits of UA trajectory. L&D represents the gap in benefits from UA, between the drought's first impacts and the post-drought context.

The seven farmers interviewed all expressed an increase in psychological, physical and social benefits associated with their uptake of UA, followed by a negative impact on these benefits when the impacts of the drought could be felt, end of 2017 and beginning of 2018. Then, a light increase of UA benefits

occurred once coping measures were adopted. A more important increase of UA benefits took place when it rained again (June 2018). Figure 7 shows that L&D is the difference of UA benefits between the beginning and the end of the drought's impacts (December 2018 to June 2019), after coping measures occurred. When coping measures were adopted but were not enough to prevent a drop in UA benefits, L&D occurred. Loss and damage thus represent the residual negative impacts of water scarcity on the benefits of farming (in orange). This figure varies among the participants depending on the degree of success in their coping measures, but a general trend shows that UA provides benefits that were reduced or lost when the 2015-2017 drought occurred, despite coping measures. This reduction in benefits represents L&D, from the understanding of the concept of L&D as residual climate change impacts (Warner et al. 2013).

Main benefits of UA	Main coping strategy	Main L&D
• Empowerment (network, solidarity, childcare) • Therapeutic effect on personal well-being • Physical health increase (food security, physical exercise, diet quality) • Source of income/Save money	• Change of water use (grey water, communal tap, wellpoint) • Ask for external help (NGO, city, province) • Illegal watering • Agricultural techniques (cover crops, shade cloths)	• Losses and damages to the benefits of UA • Losses and damages of institutional trust

Figure 8. Summary of key findings

Women farmer's benefits of UA were mostly non-material in this case-study, which contribute to the emerging literature on the non-material benefits of farming in global south cities (Slater 2001; Ward 2007; Jacobs et al. 2008; Tembo et Louw 2013; Battersby and Marshak 2013; Oliver and Heinecken 2017). The interviews show that women farmers in the low-income settlement of Gugulethu gain benefits from UA that are particularly pertinent to their group (Figure 8). For instance, the benefits of UA associated with childcare (including food security, sources of income and a place to take care of children during the day) are specific to women as childcare is often a responsibility that falls to women (Bak 2008). Furthermore, a UFC organiser explains that networks, solidarity and knowledge-sharing that happens especially between women are empowering them in the community. This finding is in line with the results of Oliver et al. (2017) explaining that networks of women farmers in low-income areas counteract the isolating effect of poverty and patriarchy experienced by woman. Therefore, the losses and damages of these benefits of UA are also specific to women. In order to reduce L&D, gender inequalities that make women more vulnerable to L&D need to be addressed at their roots (Terry 2009: 14):

> "They (gender inequalities) include women's relative lack of assets such as financial capital, but also their lower education levels compared with men, and their exclusion from decision-making at all levels over how assets such as land should be used".

As urban agriculture helps to address gender inequalities by empowering women, it is important to understand the residual impacts of climate change affecting these initiatives. In this case-study, the social, physical and psychological empowering effects of urban agriculture on women in Gugulethu have been lost or damaged during the drought because gardens got dryer. The reduction or cessation of farming was due to a mix of environmental conditions (no rain, hot and dry air, less ground water), municipal measures during the drought (municipal water price increase, forbidding of garden irrigation), and insufficient coping measures (limited access to alternative water sources, to shade, and to adaptive agricultural techniques). As a result, it appears that the participants perceived the CoCT as being responsible for: 1) the strict water restriction measures that did not take urban agriculture into account, and 2) a lack of support for urban agriculture in general and especially during the drought. From their experiences with the city officers checking that their gardens were not wet (Yoliswa and Manelisi), their increased bills for municipal water (Nopummela and Washeila) and the decrease in the city's support for urban agriculture (Magda), the informants generally lost some of their trust in the CoCT during the drought. As one of the participants explained: "I'm sure there is much that the city can do but there is no interest". Therefore, the participants experienced L&D on their institutional trust towards to CoCT in addition to L&D on their benefits from farming.

These local-level experiences of L&D happened because individual and external measures were not enough to cope with or adapt to the effects of the 2015-2017 drought. However, this L&D could be reduced or avoided if sufficient adaptation measures were in place. By looking at the barriers and enablers to adaptation, this second part will try to understand how L&D could be reduced.

5.2 Barriers to reduce loss and damage

Three main barriers to reduce L&D emerged from the participants' stories: a lack of financial capacity, a lack of external support and a lack of information on possible measures to adapt to water scarcity. Indeed, in the group of women farmers interviewed living in the low-income area of Gugulethu, five out of six were unemployed before and during their UA activities. As costs of adapting can be high, most of the participants could not afford to invest in equipment or pay higher water bills. Only one of the women farmers had the financial resources to invest into a wellpoint to be able to use aquifer water when rain stopped. The literature on barriers and enablers to adaptation and on L&D often argues that a lack of financial capacity is a major barrier to adapt to negative impacts of climate change (Deshpande et al. 2018; Rabbani et al. 2013; Bauer 2013, Warner et al.

2013). Indeed, poverty is a factor of vulnerability to climate change impacts and represents a barrier to the capacity of population to reduce L&D as shown in different case-studies. In Bangladesh, Ravani et al. (2013) conducted a case-study on the salinity-induced L&D to farming households and found that poverty was one of the main barriers to adapt and therefore responsible for huge losses in harvests. Bauer (2013) conducted a case-study on households experiencing L&D from flooding in Nepal and also found that poverty was a key driver of L&D. In urban areas as well, poverty seems to be a major driver of vulnerability to climate change's impacts and L&D. Deshpande et al. (2018) looked at barriers and enablers to adaptation in Bengaluru's informal settlement in India. The authors a found that barriers to adapt to climate change impacts for urban dwellers were economic challenges (mainly poverty), alongside social (class, caste, language and religion), governance and information challenges.

External support from governmental institutions and NGOs was seen as important for the participants to adapt to the impacts of the 2015-2017 drought. This external support during the drought was partly brought to the participants by the Western Cape DoA, by some NGOs and by initiatives such as the UFC. However, the informants expressed feeling a lack of support from the CoCT and even some anger towards city officers. As Yoliswa said about officers checking that they would not use water to irrigate their vegetable garden, there was a very "hateful" atmosphere. A sense of injustice was expressed when it came to water restrictions during the drought, where participants felt that the City did not see water-dependant UA as a valuable initiative for disadvantage communities. The high inequality levels in Cape Town are illustrated in the city's urban water use: 66% of the water is used by residents of formal housing while informal settlement use 4% (Ziervogel 2018b). As low-income areas in Cape Town already lack water services compared to other areas, water restrictions in low-income areas are perceived as unjust by some (Wilson and Pereira 2012). The general feeling from the interviewees was that the city did not really care about UA in low-income areas in the first place: "it (the city) has no interest in this type of farming, the gardens" (Provincial officer). However, the CoCT recognise the multiple benefits of UA in its policy on urban agriculture (City of Cape Town 2007). The city uses this policy to justify most of its food security advocacy work (Battersby and Marshak 2013) but does not seem to provide much support to urban poor farmers on the ground in times of water stress, according to this case-study's interviews. Harvest of Hope, a major NGO in the area, also failed to support the participants during the drought as the vegetable basket market suddenly shut down for unknown reasons, leaving the farmers without any selling platform from one day to the next.

A last key barrier to adaptation for the participant was the lack of knowledge on the support and coping measures available. Not only support was limited, but the communication about this support often did not reach the farmers interviewed. Magda represents the farmer interviewed with the most efficient adapting and coping measures during the drought. She developed a knowledge on climate resilient agriculture techniques like cover-crops by attending some NGOs' and Western Cape DoA's workshops. Even if Magda tried to spread the word on these workshops to the farming community, some interviewees did not seem to get the information. It was often the farmers that started farming recently, less integrated in farmers networks, that did not know where to find these resources during the drought. It is similar for awareness about the material help available from the Western Cape DoA and some NGOs. Farmers with experience and strong networks knew where to find material help (water tanks, borehole installations financed by NGOs or the Western Cape DoA) and knowledge on water saving techniques before and during the drought. This information did not reach the least integrated individuals in farmers networks. Exclusion from networks represents a key barrier to adapt in this case-study and confirms that most marginalised population are more at risk of L&D (Deshponde et al. 2018). Therefore, communication channels on the available help for UA in times of water scarcity and networks needs to be more developed by NGOs and governmental institutions (mostly the Western Cape DoA and the CoCT) to reach marginalised farmers.

5.3 Enablers to reduce loss and damage

The lack of information on available support for UA shows the importance of networks for the urban poor farming community. Indeed, an enabler of adaptation to climate change impacts in this case-study is found to be an access to support from the Western Cape DoA, NGOs and initiatives such as UFC. Results from other case-studies show that external support from NGOs and governmental institutions are drivers of adaptation. For instance, Singh et al. (2017) found that enablers to adaptation for an urban poor community in India included NGOs and civil society interventions. External support might be available, but it can be difficult to access as an interviewee explains: "sometimes it's not easy because they (the city) will say go there, go to that door, go to that door and you are tired at the end of the day because you come back with empty answers from them" (Manelisi). Good channels of communications and direct contact with the farmers seems to be an enabler to adaptation. The provincial officer interviewed spends a lot of time in urban farms on the Cape Flats, which allows him to understand the farmers situation better and act in times of crisis.

The high level of solidarity existing in networks of farmers in Gugulethu also helps to share information on the support available from external actors. Some said that in a group, it is easier to ask for external help. For instance, one of the interviewees working in a community garden in

Gugulethu explained that she was in charge of communicating with the municipality on their UA challenges as she is the most educated amongst the group of women farmers. She wrote a letter in the name of the whole group to request that the city changes their water meter (at the time of writing, they were still waiting for an answer). Networks are also a place to share knowledge on techniques to save water, especially if some members got training on these issues. Social networks, education levels and access to external support all enabled the farmers to adapt to the drought conditions, which is in line with the findings from Deshponde (2018; 172):

> "Some enabling factors identified in our study include (1) investment in improving human capital (e.g. providing education and vocational training and increasing awareness), (2) developing a strong social capital (e.g. improved intra-settlement communication and cohesion, strengthening existing or establishing new social networks such as self-help groups, youth clubs etc.)".

Government investments in education, employment opportunities and basic services are also enablers to adapt to droughts as suggested by Deshponde (2018). In the Gugulethu case-study, one women farmer was able to keep farming under water scarcity conditions as she had the knowledge and financial resources (by diversifying her livelihoods options) to adapt to the drought. Her higher level of education is probably key to her good understanding of the drought, of the external support available and of her knowledge on climate-resilient agricultural techniques. Tackling vulnerability to climate change at its roots is important to ensure that women farmers in low-income areas have more agency to be prepared for the eventuality of more droughts in the future.

5.4 From coping to adapting to climate change

Most of the measures taken by farmers, NGOs and governmental institutions were reactive more than proactive as "no one was prepared for such a drought" (Provincial officer). Six out of seven farmers interviewed had never tried to prepare for long-term water scarcity but rather had used coping measures once the 2015-2018 drought intensified. Singh et al. (2017) also found that informal dwellers in the city of Bengaluru, India, mostly responded to climatic risks with short-term coping strategies such as asking for help to neighbours. Droughts are projected to increase with climate change in Cape Town, which is likely to amplify the challenges faced by women farmers in low-income areas. As interviewees were mostly unaware of this future challenge, autonomous long-term adaptation strategies seemed unlikely (even if capacity were sufficient to enable it). Most of the participants' reactive responses to the 2015-2017 drought helped them to cope with the drought, but they did not reduce their structural vulnerabilities that make them susceptible to droughts in the first place. Making UA more resilient to droughts requires solid support from NGOs and local governments to address roots of vulnerability.

At the municipal level, Ziervogel (2018b) explains that the drought has shown how important it is for the CoCT to also build stronger adaptive capacity and prepare for extreme events rather than react on the short-term. In times of crisis and especially in highly unequal cities, it is difficult for a government to take decisions that considers the importance of initiatives such as UA for vulnerable communities. The city's measure of prohibiting garden irrigation or increasing water tariffs without taking into account vegetable gardens in low-income areas shows the difficulty for a city to reduce water use during a drought and try to support the most impacted at the same time. The city could support UA in a more concrete way by providing equipment to urban poor farmers and taking this water use into account when applying water restrictions. The city can also act on urban poor's development needs to build some adaptive capacity for their group. As climate change is causing L&D to those who are unable to adapt to its impacts, particularly to marginalised group in society, women urban-poor farmers would benefit from better basic services and employment opportunities (Deshpande et al. 2018: 175):

> "By providing basic services (e.g. water, electricity and sanitation), creating economic opportunities, ensuring environmental sustainability and promoting equity, existing vulnerabilities can be reduced, and well-being can be improved. Adaptive capacity is improved by services such as healthcare and education wherein the ability to cope better with various climatic and non-climatic stressors is improved".

5.5 Reducing L&D in global south cities

While the UNFCCC and the scientific literature are still defining the recent concept of L&D, this local-level case-study gives examples of concrete lived-experiences of L&D for urban-poor women. These examples of trajectories leading to L&D contribute to understand the barriers and enablers to adapt to climate changes impacts and reduce L&D in global south cities.

This study finds that reactive individual and governmental coping measures are not enough to avoid L&D. Long-term adaptation measures to prepare for the impacts of climate change accompanied by development measures to reduce vulnerability to these impacts are necessary to protect farmers in global south cities from the possibility of future droughts. As Deshpande et al. (2018: 167): "local level adaptation measures mainstreamed with local developmental agendas help address some of the structural causes of vulnerability". Especially in the case of women urban farmers, vulnerability to water scarcity needs to be addressed at its roots with long-term support from governmental institutions and NGOs. However, in global south cities with increasing populations and a range of social and economic challenges, support to urban agriculture is not necessarily a priority (city officer). This is especially the case in times of crisis such as the 2018 water crisis in Cape Town.

In the urban context, where high levels of inequality and the need to support livelihoods exist, initiatives like urban agriculture has a high potential for upliftment but is threatened by climate change impacts. If the material and non-material benefits of UA for women poor farmers and the impacts of droughts on these benefits were more known by governmental institutions, maybe these institutions would provide more support to UA activities in times of droughts, but also in general. This could reduce L&D of the benefits of UA and L&D of institutional trust towards global south cities from women urban-poor farmers. Findings from different case-studies in global south cities also show that building long-term climatic resilience is necessary to avoid L&D (Deshponde 2018; Rabbani et al. 2013; Bauer 2013, Warner et al. 2013).

6. Conclusion

The aim of this study is first to understand the L&D from droughts experienced by women farmers in low-income areas, and then understand the barriers and enablers to reducing these losses and damages.

The following objectives contribute to the aim of the study:

1) Understand the economic and non-economic benefits of farming for women in low-income areas

2) Understand long term adaptation and coping strategies to water scarcity taken by women farmers and local governments and assess the extent to which these measures reduced L&D

3) Conceptualise how this local-level case-study feeds into broader debates over barriers and enablers to reduce L&D in global south cities

By looking at the emerging literature on UA in global south cities, it appeared that women farmers in low-income areas mostly gain non-material benefits from farming. The data collected in Gugulethu for this case-study is in line with this literature as most women interviewed described important psychologic and networking benefits from their UA activities. For instance, Vuwelwa's motivation to farm is more to avoid loneliness than to get an income. The interviews in Gugulethu also showed that some benefits of UA are especially pertinent to women, such as benefits associated with childcare. Indeed, being able to bring babies to work (in the gardens) makes it easier for young mothers as childcare's responsibility often falls onto women. Similar empowering effect of UA for women are found in the recent literature on UA. For instance, Olivier et al. (2017) found that women urban-poor farmers' networking activities contributes to counteract their marginalisation in communities due to patriarchy. These benefits are hard to measure and are often not seen as important by decision-makers, even if they are important for urban farmers (UFC organiser). In Cape Town, a policy on UA exists, but a general feeling from the participants is that there is a lack of support from the city for UA.

This lack of support was especially felt by the participants at the end of the 2015-2017 drought in Cape Town. Indeed, the farmers interviewed got impacted by water scarcity as their water bills went up and city officers checked that they did not irrigate their garden. When their underground water and municipal water sources diminished and heat waves destroyed their gardens, the seven farmers adopted some coping measures. In the literature on barriers and enablers to climate change adaptation, it is often found that people adopt short-term coping measures rather than long-term adaptation measures (Warner et al. 2013). This case-study is no exception as most of the measures taken by farmers, NGOs and governmental institutions were reactive more than proactive. All of the interviewees used grey water, Nopummela carried buckets to get water at a communal tap and Magda invested in a wellpoint. Some farmers continued to use municipal water illegally to irrigate their

gardens despite the city forbidding it. A few farmers asked for support from the Western Cape DoA and local NGOs. Magda also applied some drought-resilient techniques to her garden. These measures reduced irrigation challenges, especially for Magda, but these were not enough to avoid some residual impacts of the drought. All farmers had to reduce or stop farming in early 2018. This resulted in different levels of L&D of the benefits of UA, and L&D of the farmers institutional trust towards the CoCT for their lack of support.

The three main barriers to reduce L&D in this case-study were a lack of financial capacity, a lack of external support and a lack of information on possible measures to adapt to water scarcity. Enablers to reduce L&D from the drought were access to support from the Western Cape Department of Agriculture (DoA), higher levels of education, a diversity of livelihoods and a strong network with other farmers. Networks between women farmers helped them to get information on available external support and on alternative water sources as well as drought-resilient agricultural techniques. A major enabler to adapt to the drought and reduce L&D were higher levels of education and employment opportunities for livelihoods diversification. Indeed, tackling vulnerability to climate change at its roots with development measures is important to ensure that women farmers in low-income areas have more agency to be prepared for the eventuality of more droughts in the future. These findings are in line with the recent literature on barriers and enablers to adaptation and ways to reduce L&D. Long-term adaptation measures to prepare for the impacts of climate change accompanied by development measures to reduce vulnerability to these impacts are often seen as a priority to protect farmers in the global south from the possibility of future droughts. As interviewees were mostly unaware of the challenge of future droughts and did not have the capacity to adapt, long-term adaptation strategies seemed unlikely without external support from the governmental institutions and NGOs.

Urban agriculture has a high potential for upliftment in global south cities like Cape Town. However, it is threatened by climate change impacts like droughts. If material and non-material benefits of UA for women poor farmers and the impacts of droughts on these benefits were more known by governmental institutions, maybe these institutions would provide more support to UA, especially in times of droughts. This could reduce L&D of the benefits of UA and L&D of institutional trust from women urban-poor farmers in global south cities.

Yet, more research is needed on the emerging concept of L&D. It is hard to distinguish if climate change residual impacts are permanent or not, which is why most studies treat L&D as blended concept. Even if loss is often associated with something permanent while damage is considered as "repairable", can we consider non-material L&D such as loss of institutional trust as "repairable"? In this study, the concept of L&D was thus useful as a blended concept but still needs more research to

be better defined. More research is also needed on compensation for L&D that already occurred or is unavoidable, which is an important emerging concept in the climate justice field.

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8. Appendices

8.1 Interview List

Interview no.	Interviewee	Data and Time of Interview
1	Man Farmer 1 (Manelisi)	28 September 2018 – 13:00
2	Woman farmer 1 (Vuyelwa)	28 September 2018 – 15:00
3	Family member 1 (Vuyelwa's daughter)	28 September 2018 – 16:00
4	Woman farmer 1 (Vuyelwa)	09 October 2018 – 13:00
5	Woman farmer 2 (Agnes)	09 October 2018 – 14:30
6	Woman farmer 3 (Yoliswa)	18 October 2018 – 13:30
7	Woman farmer 7 (Vuyokazi)	25 October 2018 – 14:00
8	Woman farmer 4 (Washiela)	08 November 2018 – 11:00
9	Woman farmer 5 (Magda)	15 November 2018 – 13:30
10	Woman farmer 6 (Nopummela)	15 November 2018 – 16:00
11	UFC organiser 1 (Emma)	20 November 2018 – 10:00
12	UFC organiser 2 (Kim)	20 November 2018 – 10:30
13	Provincial officer (Ayanda)	21 December 2018 – 10:00

8.2 Questionnaires

Farmers (7)

GENERAL

1. Can you tell me about how you became involved in urban farming?
2. What were your main motivations in starting farming?
3. Is this your main activity?
4. Why did you join the Umthunzi Farming Community?
5. For how long have you been farming for?
6. What size is your garden/farm?
7. Do you farm alone? How many are you?
8. Do you own the land?
9. What water do you use for farming? What quality?
10. What is your water bill?
11. Do you store water?
12. What do you grow?
13. How do you use the vegetables?
14. How many people live in your home?

MOTIVATIONS AND BENEFITS OF UA

1. What positive effects does farming have on you/your family/your community?
2. How important is the income you get from farming?
3. Has your diet change since you started farming?
4. Do you like this activity? How does farming contribute to your wellbeing? Has it allow you to feel more in control of your life?
   Do you feel empowered in your community?
5. Did you develop a larger network with this activity? Did you make friendships with other farmers? How do you help each other?
6. Do you see differences in the benefits of farming for women and men? Can you provide some examples?

CHALLENGES OF DROUGHT

1. What are the challenges with farming that concern you?
2. Is it harder or easier to be a women farmer?
3. Do you plan for droughts when farming? (choice of seeds, water systems...)
4. Why was the drought a challenge?
5. Were there some city measures in term of water that affected you during the drought? How?
6. Do you know famers that had to stop growing food because of the drought? Why?
7. What measures did you take to manage the water scarcity?
8. What measures worked well and what measures didn't work well?
9. What impacts of the drought happened despite the measures?
10. What benefits of farming were damaged or lost because of water scarcity?

WAY FORWARD

1. How do you engage with the city, NGOs on these issues?
2. What could the city do to support UA in times of drought?
3. Does the community support farming? What role could they play?

4. How do you see environmental hazards and climate change affecting UA in the future?
5. Still possible to farm under droughts?

Family member (1)

BENEFITS OF UA

1. What positive effects does farming have on you/your family/your community?
2. Did your diet change since your family member started farming?
3. Do you take pride in having a family member farming? Do you fell that your family is empowered by this activity in your community?
4. Did your family develop a larger network with this activity?
5. Do you see differences in the benefits of farming for women and men? Can you provide some examples?

CHALLENGES OF DROUGHT

1. What are the biggest challenges in farming?
2. Why was the drought a challenge?
3. Do you know famers that had to stop growing food because of the drought? Why?
4. What benefits of farming were damaged or lost because of water scarcity?

WAY FORWARD

1. What could the city do to support UA in times of drought?
2. How do you see environmental hazards and climate change for UA in the future?

Provincial officer (1)

GENERAL

1. What is your position?
2. How many farmers are you in contact with?
3. How do you contact them?
4. How often do you interact with urban farmers?

BENEFITS OF UA

1. What positive effects does farming have on farmers?
2. Is there some form of organisation between farmers?
3. Do you see differences in the benefits of farming for women and men? Can you provide some examples?

CHALLENGES OF DROUGHT

1. What are the biggest challenges in farming?
2. Why was the drought a challenge?
3. Do you know famers that had to stop growing food because of the drought? Why?
4. What benefits of farming were damaged or lost because of water scarcity?
5. What measures from the Western Cape Department of Agriculture affected or supported the farmers during the drought?
6. What measures from the CoCT affected or supported the farmers during the drought?

WAY FORWARD

1. What could the Western Cape Department of Agriculture do to support UA in times of drought?
2. What could the city do to support UA in times of drought?
3. How do you see environmental hazards and climate change for UA in the future?

UFC organisers (2)

GENERAL

1. Can you tell me how your organisation started?
2. What is the aim of this initiative?
3. What is your role in the organisation?
4. How many farmers are part of it?
5. What are the profiles of the members? (Gender, age, experience of farming, other activities...)

MOTIVATIONS AND BENEFITS OF UA

1. What the you perceive as the main motivations leading your members to farm?
2. What the you perceive as the main motivations leading your members to join your organization?
3. What the you perceive as the main benefits from farming?
4. How are these motivations and benefits gender-specific?

CHALLENGES OF THE DROUGHT

1. What do you see as the biggest challenges for the farmers to grow vegetables?
2. Do you exchange on these challenges with the farmers?
3. Are there gender-specific?
4. Can you explain how your organisation tries to reduce these challenges?
5. How do you engage with the city and other NGOs on these issues?
6. How did the drought affect UA on the Cape Flats?
7. What are the main sources of water of the members?
8. Did it change with the drought?
9. Were there some city's measures in term of water that affected the farmers during the drought? How?
10. What were the strategies adopted by the farmers to adapt and coop with water scarcity? Which worked and which didn't?
11. Do you know famers that had to stop growing food because of the drought? Why?
12. What level of agency do the farmers have to adapt to water scarcity?
13. Can they engages easily with city officials on this challenge?

THE WAY FORWARD

1. Do you see the drought as a climate change-related stressor that is going to intensify in the future?
2. Is it a main threat to your organisation? Are you planning on taking measures on this challenge?
3. What could the city do to make it easier for UA in times of drought?

8.3 Consent form

DEPARTMENT OF ENVIRONMENTAL & GEOGRAPHICAL SCIENCE
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Informed Voluntary Consent to Participate in Research Study

Project Title: Loss and damage from droughts: Material and non-material impacts of water scarcity on women farmers in Gugulethu, Cape Town

Invitation to participate, and benefits: You are invited to participate in a research study conducted with members of the Umthunzi Farming Community (farmers, family members and organisers). The study aim is to develop a better understanding of the barriers and enablers to reducing the material and non-material loss and damage from droughts for women farmers in informal settlements. I believe that your experience would be a valuable source of information, and hope that by participating you may gain useful knowledge.

Procedures: During this study, you will be asked to talk about your experience of urban farming.

Recording: We may take photographs, record audio, or record video as part of the study. If you object to this, please indicate this below.

Risks: There are no potentially harmful risks related to your participation in this study.

Disclaimer/Withdrawal: Your participation is completely voluntary; you may refuse to participate, and you may withdraw at any time without having to state a reason and without any prejudice or penalty against you. Should you choose to withdraw, the researcher commits not to use any of the information you have provided without your signed consent. Note that the researcher may also withdraw you from the study at any time.

Confidentiality: All information collected in this study will be kept private in that you will not be identified by name or by affiliation to an institution. Confidentiality and anonymity will be maintained as pseudonyms will be used.

What signing this form means: By signing this consent form, you agree to participate in this research study. The aim, procedures to be used, as well as the potential risks and benefits of your participation have been explained verbally to you in detail, using this form. Refusal to participate in or withdrawal from this study at any time will have no effect on you in any way. You are free to contact me, to ask questions or request further information, at any time during this research.

I agree to participate in this research (tick one box) ☐ Yes ☐ No _____ (Initials)

I agree to be photographed/audio-recorded/video-recorded ☐ Yes ☐ No _____ (Initials)

I agree to the use of properly anonymized photographs/audio recordings/videos in websites and publications for research purposes ☐ Yes ☐ No _____ (Initials)

_____	_____	_____
Name of Participant	Signature of Participant	Date
_____	_____	_____
Name of Researcher	Signature of Researcher	Date